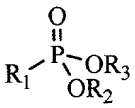
WHAT IS CLAIMED IS:

1. A composition useful in applications where catalyst immobilization or ligation is utilized, comprising:

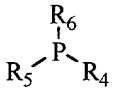
a polymer compound comprising:

at least one subunit with the chemical structure:



where R_1 is a substituted or unsubstituted alkyl group, a substituted or unsubstituted aryl group or a substituted or unsubstituted heterocyclic group and where R_2 and R_3 are hydrogen atoms; and

at least one subunit with the chemical formula:

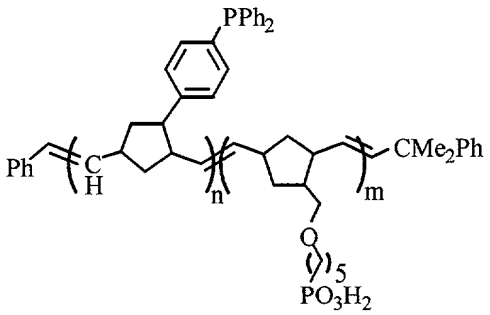


where R_4, R_5 and R_6 are substituted or unsubstituted alkyl groups, substituted or unsubstituted aryl groups, substituted or unsubstituted heterocyclic groups, or hydrogen atoms, and may be the same or different.

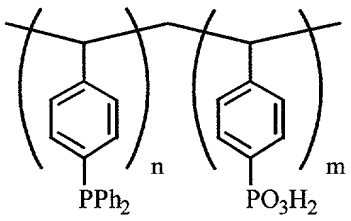
2. The composition of claim 1, wherein said polymer compound is a random copolymer.

3. The composition of claim 1, wherein said polymer compound is a block copolymer.

4. The composition of claim 1, wherein said polymer compound has the chemical structure:



5. The composition of claim 1, wherein said polymer compound has the chemical structure:



6. A method of catalyst immobilization, comprising the steps of:

(a) providing a polymer capable of both ligating to said catalyst and binding to a surface of a substrate;

(b) binding said polymer to said surface of said substrate; and

(c) ligating said catalyst to said polymer that is bound to said surface of said substrate.

7. The method of claim 6, wherein said catalyst is selected from the group consisting of: metal nanoparticle, metal colloid, semiconductor nanoparticle, metal ion, metal complex, electroless plating catalyst, palladium/tin colloid, and combinations thereof.

8. The method of claim 6, wherein said substrate is selected from the group consisting of: silicon oxide, titanium oxide, zirconium oxide, indium tin oxide, indium zinc oxide, tin oxide, zinc oxide, copper oxide, aluminum oxide, nickel oxide, and combinations thereof.

9. The method of claim 6, wherein said substrate comprises a polymer with surface hydroxyl groups.

10. A method of catalyst immobilization, comprising the steps of:

(a) providing a polymer capable of both ligating to a catalyst and binding to a surface of a substrate;

(b) ligating said catalyst to said polymer, wherein a polymer-bound catalyst is provided; and

(c) binding said polymer-bound catalyst to said surface of said substrate.

11. The method of claim 10, wherein said catalyst is selected from the group consisting of: metal nanoparticle, metal colloid, semiconductor nanoparticle, metal ion, metal complex, electroless plating catalyst, palladium/tin colloid, and combinations thereof.

12. The method of claim 10, wherein said substrate is selected from the group consisting of: silicon oxide, titanium oxide, zirconium oxide, indium tin oxide, indium zinc oxide, tin oxide, zinc oxide, copper oxide, aluminum oxide, nickel oxide, and combinations thereof.

13. The method of claim 10, wherein said substrate comprises a polymer with surface hydroxyl groups.

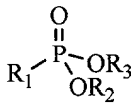
14. A method of deposition of metallic film on a substrate comprising the steps of:

(a) patterning a ligating chemical agent onto a surface of said substrate;

(b) ligating an electroless metal plating catalyst to said ligating chemical agent; and

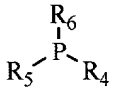
(c) exposing an electroless metal plating solution to said catalyst, thereby forming a metallic film on said substrate.

15. The process of claim 14, wherein said ligating chemical agent comprises at least one subunit with the chemical structure:



where R_1 is a substituted or unsubstituted alkyl group, a substituted or unsubstituted aryl group or a substituted or unsubstituted heterocyclic group and where R_2 and R_3 are hydrogen atoms; and

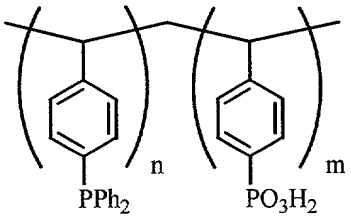
at least one subunit with the chemical formula:



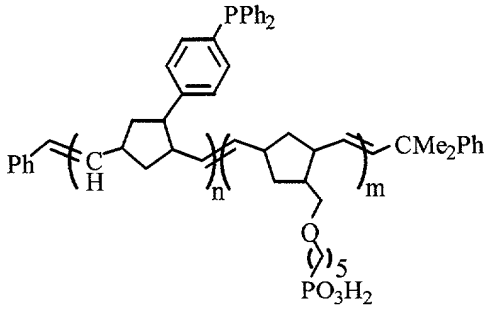
where R_4, R_5 and R_6 are substituted or unsubstituted alkyl groups, substituted or unsubstituted aryl groups, substituted or unsubstituted heterocyclic groups, or hydrogen atoms, and may be the same or different.

16. The method of claim 14, wherein said ligating chemical agent is a bifunctional molecular species of the form $R_7R_8P(CH_2)_nPO_3R_9R_{10}$, wherein n is between 1 and 20, and wherein R_7 and R_8 are substituted or unsubstituted alkyl groups, substituted or unsubstituted aryl groups, or substituted or unsubstituted heterocyclic groups, and may be the same or different, and wherein R_9 and R_{10} are hydrogen atoms.

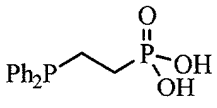
17. The method of claim 14, wherein said ligating chemical agent has the chemical structure:



18. The method of claim 14, wherein said ligating chemical agent has the chemical structure:



19. The method of claim 14, wherein said ligating chemical agent has the chemical structure:



20. The method of claim 14, wherein said substrate is selected from the group consisting of: silicon oxide, titanium oxide, zirconium oxide, indium tin oxide, indium zinc oxide, tin oxide, zinc oxide, copper oxide, aluminum oxide, nickel oxide, and combinations thereof.

21. The method of claim 14, wherein said substrate comprises a polymer with surface hydroxyl groups.

22. The method of claim 14, wherein said electroless plating catalyst is a palladium catalyst.

23. The method of claim 14, wherein said electroless plating catalyst is a palladium-tin colloid.

24. The method of claim 14, wherein said electroless plating solution is selected to deposit metals from the group consisting of: cobalt, nickel, copper, gold, platinum, palladium, silver, and alloys thereof.

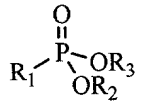
25. A method of rendering a substrate catalytic to electroless metal deposition comprising the steps of:

(a) depositing a ligating chemical agent on said substrate, which is capable of both binding to said substrate and ligating to an electroless plating catalyst; and

(b) ligating said electroless plating catalyst to said ligating chemical agent.

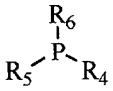
26. The method of claim 25, further comprising, after step (a), the step of contacting said substrate with a chemical reagent capable of reacting with at least one functional group of said ligating chemical agent.

27. The method of claim 25, wherein said ligating chemical agent comprises at least one subunit with the chemical structure:



where R_1 is a substituted or unsubstituted alkyl group, a substituted or unsubstituted aryl group or a substituted or unsubstituted heterocyclic group and where R_2 and R_3 are hydrogen atoms; and

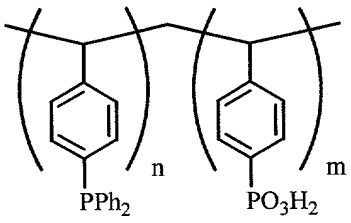
at least one subunit with the chemical formula:



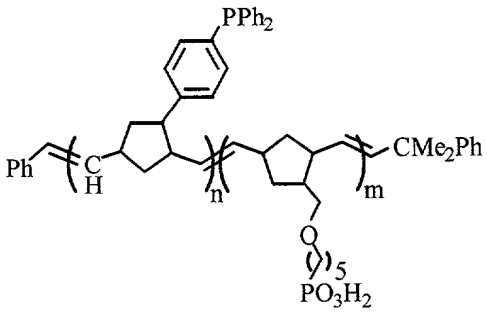
where R_4, R_5 and R_6 are substituted or unsubstituted alkyl groups, substituted or unsubstituted aryl groups, substituted or unsubstituted heterocyclic groups, or hydrogen atoms, and may be the same or different.

28. The method of claim 25, wherein said ligating chemical agent is a bifunctional molecular species of the form $R_7R_8P(CH_2)_nPO_3R_9R_{10}$, wherein n is between 1 and 20, and wherein R_7 and R_8 are substituted or unsubstituted alkyl groups, substituted or unsubstituted aryl groups, or substituted or unsubstituted heterocyclic groups, and may be the same or different, and wherein R_9 and R_{10} are hydrogen atoms.

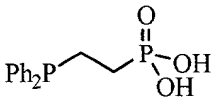
29. The method of claim 25, wherein said ligating chemical agent has the chemical structure:



30. The method of claim 25, wherein said ligating chemical agent has the chemical structure:



31. The method of claim 25, wherein said ligating chemical agent has the chemical structure:



32. The method of claim 25, wherein said substrate is selected from the group consisting of: silicon oxide, titanium oxide, zirconium oxide, indium tin oxide, indium zinc oxide, tin oxide, zinc oxide, copper oxide, aluminum oxide, nickel oxide, and combinations thereof.

33. The method of claim 25, wherein said substrate comprises a polymer with surface hydroxyl groups.

34. The method of claim 25, wherein said electroless plating catalyst is a palladium catalyst.

35. The method of claim 25, wherein said electroless plating catalyst is a palladium-tin colloid.

36. The method of claim 25, wherein said electroless plating solution is selected to deposit metals from the group consisting of: cobalt, nickel, copper, gold, platinum, palladium, silver, and alloys thereof.

37. A process of patterning a substrate in a selective pattern, comprising the steps of:

(a) providing a substrate having a surface with hydroxyl groups;

(b) providing an applicator having a surface with at least one indentation;

(c) coating said applicator surface with a ligating chemical agent;

(d) positioning said coated applicator on said substrate such that at least a portion of said substrate has said ligating chemical agent bound thereto;

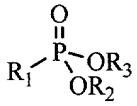
(e) removing said applicator from said substrate, wherein a patterned film of said ligating chemical agent remains on said substrate;

(f) ligating an electroless plating catalyst to said ligating chemical agent, thereby forming a catalyzed substrate; and

(g) depositing metal on said catalyzed substrate, thereby forming a metal deposit in a predetermined pattern.

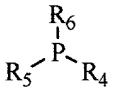
38. The process of claim 37, wherein said applicator is a stamp.

39. The process of claim 37, wherein the ligating chemical agent comprises at least one subunit with the chemical structure:



where R_1 is a substituted or unsubstituted alkyl group, a substituted or unsubstituted aryl group or a substituted or unsubstituted heterocyclic group and where R_2 and R_3 are hydrogen atoms; and

at least one subunit with the chemical formula:



where R_4, R_5 and R_6 are substituted or unsubstituted alkyl groups, substituted or unsubstituted aryl groups, substituted or unsubstituted heterocyclic groups, or hydrogen atoms, and may be the same or different.

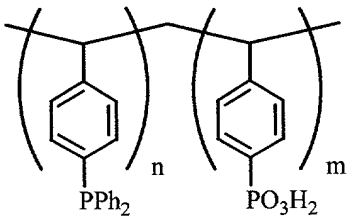
40. The process of claim 37, wherein said ligating chemical agent is a random copolymer.

41. The process of claim 37, wherein said ligating chemical agent is a block copolymer.

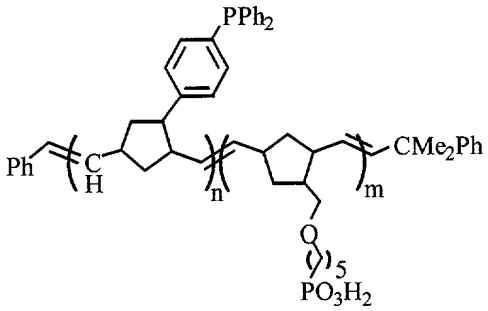
42. The process of claim 37, wherein said ligating chemical agent is a bifunctional molecular species of the form $R_7R_8P(CH_2)_nPO_3R_9R_{10}$, wherein n is between 1 and 20, and wherein R_7 and R_8 are substituted or unsubstituted alkyl groups, substituted

or unsubstituted aryl groups, or substituted or unsubstituted heterocyclic groups, and may be the same or different, and wherein R_9 and R_{10} are hydrogen atoms.

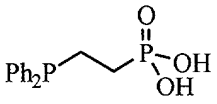
43. The process of claim 37, wherein said ligating chemical agent has the chemical structure:



44. The process of claim 37, wherein said ligating chemical agent has the chemical structure:



45. The process of claim 37, wherein said ligating chemical agent has the chemical structure:



46. The process of claim 37, wherein said substrate is selected from the group consisting of: silicon oxide, titanium oxide, zirconium oxide, indium tin oxide, indium

zinc oxide, tin oxide, zinc oxide, copper oxide, aluminum oxide, nickel oxide, and combinations thereof.

47. The process of claim 37, wherein said substrate comprises a polymer with surface hydroxyl groups.

48. The process of claim 37, wherein said electroless plating catalyst is a palladium catalyst.

49. The process of claim 37, wherein said electroless plating catalyst is a palladium-tin colloid.

50. The process of claim 37, wherein said plating metal is selected from the group consisting of: cobalt, nickel, copper, gold, platinum, palladium, silver, and alloys thereof.

51. The process of claim 37, further comprising, after step (g), the step of depositing a second metal on said first metal deposited.

52. An article of manufacture comprising a substrate having a metal coating over portions of said substrate in a selected pattern and being bonded to said substrate through an intermediate layer of catalyzed ligating chemical agent.

53. The article of claim 52, wherein said catalyzed ligating chemical agent comprises a ligating chemical agent having at least one functional group bonded to said substrate.

54. The article of claim 52, wherein said catalyzed ligating chemical agent comprises a ligating chemical agent with at least one functional group bonded to said substrate and at least one other functionality bonded to an electroless plating catalytic material.

55. The article of claim 52, wherein said catalyzed ligating chemical agent comprises an electroless plating catalyst electrostatically bound to a ligating chemical agent.

56. The article of claim 52, wherein said catalyzed ligating chemical agent comprises an electroless plating catalyst coordinatively bonded to a ligating chemical agent.